DECLARATION

I, Yukie HASEGAWA of c/o KOYO INTERNATIONAL TECHNICAL INSTITUTE. INC., Nikko Kagurazaka Building, 18 Iwato-cho, Shinjuku-ku, Tokyo, Japan, do hereby solemnly and sincerely declare, that I have a thorough knowledge of the Japanese and English languages, and that the attached pages contain a correct translation into English of the specification of Japanese Patent Application No. 2003-037182 filed on February 14, 2003 in the name of TOMY COMPANY, LTD.

Declared at Tokyo, Japan

Signed this 15th day of September, 2006

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[TYPE OF DOCUMENT]	Specification	1
[TYPE OF DOCUMENT]	Drawings	1
[TYPE OF DOCUMENT]	Abstract	1

[NECESSITY OF PROOF] Necessary

[DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] TOY VEHICLE

[PATENT CLAIM]

[Claim 1] A toy vehicle which performs running control and steering control according to a signal from a radio controller, comprising:

a motor mounted on a front side, for driving a front wheel.

[Claim 2] The toy vehicle as claimed in Claim 1, wherein the motor is mounted in front of a front wheel axle.

[Claim 3] The toy vehicle as claimed in Claim 1 or 2, wherein the motor is detachably mounted thereon.

[Claim 4] The toy vehicle as claimed in any one of Claims 1 to 3, wherein a rear wheel is provided with a suspension structure.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field of the Invention]

The present invention relates to a toy vehicle which performs running control and steering control according to a signal from a radio controller.

[0002]

[Background Art]

Earlier, a toy vehicle which performs running control and steering control according to a signal from a radio

controller has been well known. The toy vehicle drives rear wheels to run, and changes a direction of front wheels to perform steering by receiving a signal from the radio controller (Patent Document 1,).

[0003]

[Patent Document 1]

Japanese Patent Application Publication (Unexamined) No. Tokukai-2002-166064

[0004]

[Problem to be Solved by the Invention]

A rear-wheel-drive vehicle raises a problem in operability. Specially, when running the toy vehicle on a floor face, the rear wheels of the toy vehicle slips on the floor face, thereby making a control difficult.

The present invention has been developed in view of solving the problem, and an object of the present invention is to provide a toy vehicle with excellent operability.

[0005]

[Means for Solving the Problem]

In accordance with the invention recited in Claim 1, a toy vehicle which performs running control and steering control according to a signal from a radio controller, comprises a motor mounted on a front side thereof, wherein the motor drives a front wheel. A position for mounting the motor may be on a front side of a front wheel axle as in a toy vehicle of a second aspect of the invention, or

just behind the front wheel axle. A steering method is not particularly limited, however, the steering can be performed by a four-section rotational linkage. A driving method for the four-section rotational linkage is not limited, however, the four-section rotational linkage can be driven by utilizing a repulsive force or an attraction force acting between a permanent magnet (or a non-magnetized magnetic material) and a coil.

According to the toy vehicle, since the motor is mounted near the front wheel for performing steering, it can provide an excellent road holding by the weight of the motor. Moreover, since the toy vehicle is a front-wheel-drive vehicle, the operability is improved.

[0006]

A toy vehicle according to the invention recited in Claim 3 is the toy vehicle recited in Claim 1 or Claim 2 of the invention, wherein the motor is detachably mounted on the chassis. In this case, it is preferable to prepare motors with different properties in revolution speed, torque or the like.

According to the toy vehicle, the motor can be replaced to that with the number of revolutions according to the course.

[0007]

A toy vehicle according to the invention recited in Claim 4 is the toy vehicle of any one of Claim 1 to 3 of

the invention, wherein a rear wheel is provided with a suspension structure.

According to the toy vehicle, since the road holding of the rear wheel is improved, the toy vehicle can run stably.

[0008]

[PREFERRED EMBODIMENTS OF THE INVENTION]

[First Embodiment]

FIG. 1 is a perspective view of a toy vehicle. The toy vehicle 1 is configured to move back and forth, and turn to the right or left according to control signals from a radio controller which is not shown. The configuration of the toy vehicle 1 will be explained in detail below.

[0009]

FIG. 2 shows the toy vehicle 1 in a state where a body 2 is removed.

[0010]

(Attaching Structure of Motor)

A motor M1 for driving front wheels 3 is disposed at a front portion of a chassis 4. The motor M1 is attached to the chassis 4 so that a motor shaft 5 extends in a width direction of the toy vehicle 1.

The motor M1 is attachable/detachable from the lower side of the chassis 4, and is covered at the lower side by a cover body 6 in a state of being attached to the chassis

4

[0011]

(Structure of Cover Body)

The cover body 6 is attachable/detachable to the chassis 4. As shown in FIG. 3(b), the cover body 6 can be attached to the chassis 4 from the front side thereof. The cover body 6 comprises a bottom plate part 6a for covering the lower side of the motor M1 and a standing part 6b which stands from the bottom plate part 6a as shown in FIG. 3(a). The standing part 6a is provided with a protrusion 7 on the inside thereof. Claws 8 are provided at both sides of the bottom plate part 6a. A slit 9 of the cover body 6 is formed near each of the claws 8 of the bottom plate part 6a and outer portions of the slits 9 (portions where the claws 8 are provided) are elastically deformable to the inside of the cover body 6.

In attaching the cover body 6 to the chassis 4, the bottom plate part 6a is inserted in a hole 4b of the bottom plate part of the chassis 4, and a protrusion 7 inside of the standing part 6b is engaged with a hole 4a in a front plate portion of the chassis 4. Because of the elasticity of the claws 8, the claws 8 at both sides of the bottom plate part 6a are engaged with the dents (not shown) which are formed on the inner surface of the hole 4b of the bottom plate part of the chassis 4.

[0012]

(Power Transmission Mechanism)

As shown in FIG. 4, a gear 10 which is fixed on a motor shaft 5 is engaged with a large diameter gear 12 which is fixed on a intermediate shaft 11 which is disposed to be in parallel with the motor shaft 5. A small diameter gear 13 is fixed on the intermediate shaft 11. The intermediate shaft 11 is attachably/detachably engaged to the slit 4c of the chassis 4 from upper side and other rotation shafts providing gears with different number of teeth may be attached thereto.

[0013]

The gear 13 is engaged with a large diameter gear 15 which is fixed on the front wheel axle 14 which is disposed to be in parallel with the intermediate shaft 11. Each side of the front wheel axle 14 is connected through a flexible joint 16 to a front wheel 3.

[0014]

As shown in FIG. 5, each flexible joint 16 comprises a cylindrical body 18 fixed on the front wheel axle 14, and a spindle 19 which is fixed to the front wheel 3 at an outer end and has a spherical shaped part 19a at the inner end which is inserted to the cylindrical body 18. In the cylindrical body 18, slits 18a are formed at positions opposite to each other across the center of an axis of the cylindrical body 18. The spherical shaped part 19a of the spindle 19 is provided with protrusions 19b which fit into

the slits 18a.

[0015]

According to the power transmission mechanism of the above configuration, the power from the motor is transmitted to the front wheels 17 through the gears 10 and 12, the intermediate shaft 11, the gears 13 and 15, the front wheel axle 14 and the flexible joints 16.

[0016]

(Steering Mechanism)

The toy vehicle 1 comprises a driving link 21 and a right and left driven links 22 which forms a turning pair with the driving link 21. These links form a four-section rotational linkage in which the chassis portion between the shafts 23, 23 of the right and left driven links 21 acts as a fixed link. When the driving link 21 and the right and left driven links sway centering around the shafts 23, the direction of the front wheels 3 supported by vertical plates 22a of the driven links 22 (refer to FIG. 2) is adapted to change in linking with the driven links 22.

As shown in FIG. 6, on the lower side of the central portion of the driving link 21, a permanent magnet 24 is provided. The permanent magnet 24 is formed in a disk shape, and both end surfaces thereof face in the right and left directions, respectively. One end surface of the permanent magnet 24 is a south pole, and the other one thereof is a north pole. The chassis 4 is provided with

coils 25 at positions across the permanent magnet 24. One end parts of coils 25 face the end surfaces of the permanent magnet 24 provided on the driving link 21.

Each shaft 23 is positioned such that the shaft line of each shaft 23 passes through the connecting part of the front wheel 14 and the spindle 19, that is, the spherical shaped part 19a. In other words, three shaft lines of the shaft 23, the front wheel shaft 14 and the spindle 19 intersect each other.

[0017]

FIG. 7 shows a portion of the coil driving circuit. Energization of the coil driving circuit is controlled by a control device. The coil driving circuit is configured to energize both of the right and left coils 25 at the same time. When both of the coils 25 are energized at the same time, the polarities of the coils 25 on the sides which face the end surfaces of the permanent magnet 24 become homopolar (north pole or south pole). Accordingly, when the right and left coils 25 are energized, attractive force is generated between one coil 25 and the permanent magnet 24, and repulsive force is generated between the other coil 25 and the permanent magnet 24. Therefore, the driving link 21 and thus the driven links 22 sway centering around the shaft 23, thereby changing the direction of the front wheels 3.

[0018]

(Suspension Structure of Rear Wheel)

A rear wheel axle (not shown) of right and left rear wheels 34 is covered by an axle cover 30. The axle cover 30 is provided with a shaft 31 which extends in the back and forth directions of the toy vehicle 1, and the shaft 31 is supported by the chassis 4. Thus, the right and left rear wheels 34 perform seesaw movement centering on the shaft 31. The axle cover 30 is provided with projected pieces 32 on the right and on the left. Each of the projected pieces 32 is provided with a coil spring 33 at a tip thereof. The coil springs 33, 33 are adapted to contact with the bottom plate portion of the chassis 4 from the lower side, thereby absorbing the up and down movement of the toy vehicle 1.

[0019]

(Circuit Structure)

As shown in FIG. 8, the control signals from the radio controller are received by an antenna (not shown) to perform demodulation or the like by a processing section 40. A control device 42 controls a coil driving circuit 44 and a motor driving circuit 45, and thus the motor M1 and the coils 25 according to operation program stored in a storing section 41. These circuit elements are mounted on a circuit board 43.

[0020]

(Other Structure)

The circuit board 43 is provided with a battery storage space (not shown) at the lower side thereof, in which a battery can be mounted.

[0021]

(Operation and Effect of Toy Vehicle in the Embodiment)

Since the motor M1 is disposed near the front wheels 3 for performing steering, the road holding of the front wheels 3 is improved by the weight of the motor M1. Moreover, since the toy vehicle 1 is a front-wheel-drive vehicle, the operability is improved.

Since the motor M1 can be replaced according to the course, it can realize broad options for playing, thereby increasing interest in playing.

The suspension structure is provided on the rear wheels 34 side, so that the road holding of the rear wheels 34 is improved, thereby realizing stable running.

[0022]

[Second Embodiment]

FIG. 9 shows a power transmission mechanism, a steering mechanism and a suspension structure of a toy vehicle in the second embodiment. In this embodiment, the power transmission mechanism and the suspension structure of the toy vehicle are different from those in the first embodiment. Other structures are similar to those of the toy vehicle 1 in the first embodiment, thus the explanation thereof is omitted here.

[0023]

(Power Transmission Mechanism)

In the power transmission mechanism in this embodiment, the gears 12 and 13 of the toy vehicle 1 in the first embodiment are united.

[0024]

(Suspension Structure)

The right and left rear wheels 34 are supported by swaying arms 52 which sway up and down centering around a shaft 51 which is in parallel with rear wheel axles 50. The swaying arms 52 on right and left sides are individually movable up and down. A projected piece 54 which extends backward is provided on each of the cylinder shafts 53 which are end portions of the swaying arms 52. A spring 55 is provided at each tip part of the projected pieces 54. The springs 55 are adapted to contact with the bottom plate portion of the chassis 4 from the lower side to absorb the up and down movement of a toy vehicle 1.

[0025]

[Third Embodiment]

FIG. 10 shows a power transmission mechanism, steering mechanism and suspension structure of a toy vehicle in the third embodiment. In this embodiment, the power transmission mechanism of the toy vehicle is different from that in the first embodiment. Other structures are similar to those of the toy vehicle 1 in the

first embodiment, thus the explanation thereof is omitted here.

[0026]

(Power Transmission Mechanism)

As shown in FIG. 10, a gear 60 is fixed on the motor shaft 5. The intermediate shaft 11 is disposed to be in parallel with the motor shaft 5, and a large diameter gear 61 is fixed on the intermediate shaft 11. The gears 60 and 61 are engaged with each other. A small diameter gear 62 is also fixed on the intermediate shaft 11 integrally with the gear 61. The gear 61 is engaged with a gear 63 fixed on one of front wheel axle (not shown in drawing). One of front wheels 3 is fixed on the front wheel axle.

[0027]

A gear 65 having the same diameter and the same number of teeth as those of the gear 62 is fixed on the intermediate shaft 11. The gear 65 is engaged with a gear 66 fixed on the other front wheel axle (not shown). The other front wheel 3 is fixed on the front wheel axle.

[0028]

According to the power transmission mechanism, the power from the motor is transmitted to one front wheel 3 through the gears 60, 61, 62, 63 and the intermediate shaft 11, and also transmitted to the other front wheel 3 through the gears 60, 61, the intermediate shaft 11, the gears 65 and 66.

[0029]

In the toy vehicle 1, the shafts 23 of the right and left driven links 22 are positioned such that the shaft lines of the shafts 23 pass through engaged portions of the gears 62 and 63, and the gears 65 and 66, respectively. Even when the right and left driven links 22 sway, the engagements of the gears 62 and 63, and the gears 65 and 66 are not released. This configuration does not need the flexible joint 16.

[0030]

(Suspension Structure)

Suspension structure is similar to that in the first embodiment.

[0031]

[Modification of the Present Invention]

For example, in the embodiments above described, the permanent magnet 24 is provided on the driving link 21, and the coils 25 are provided at both sides thereof. However, on the contrary, the coil 25 may be provided on the driving link 21, and the permanent magnets 24 may be provided at both sides thereof. Also, a non-magnetized magnetic material may be provided instead of the permanent magnet 24. That is, any structure may be employed if the driving link 21 is swayed by an electromagnetic force.

[0032]

A return spring may be provided for making the

driving link 21 keep a neutral position in right and left directions.

[0033]

[Effect of the Invention]

An effect of the representative elements of the present invention is, a toy vehicle, which performs running control and steering control according to a signal from a radio controller, comprising a motor for driving a front wheel mounted on a front part of a chassis to realize an excellent road holding by the weight of the motor as well as significantly improved operability because of the front-wheel-drive structure.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIG. 1]

A perspective view showing a toy vehicle in the first embodiment

[FIG. 2]

A perspective view showing a state where a body is removed from the vehicle toy in FIG. 1

[FIG. 3]

A perspective view for explaining an attaching structure of a motor of the vehicle toy in FIG. 1

[FIG. 4]

A plan view showing a power transmission mechanism, a steering mechanism, and a suspension structure of the toy

vehicle in FIG. 1

[FIG. 5]

A perspective view showing a flexible joint of the toy vehicle in FIG. 1

[FIG. 6]

A perspective view showing a link driving mechanism of the toy vehicle in FIG. 1

[FIG. 7]

A view showing a part of a coil driving circuit of the toy vehicle in FIG. 1

[FIG. 8]

A view showing a circuitry of the toy vehicle in FIG. 1

[FIG. 9]

A plan view showing a power transmission mechanism, a steering mechanism, and a suspension structure of a toy vehicle of the second embodiment

[FIG. 10]

A plan view showing a power transmission mechanism, a steering mechanism, and a suspension structure of a toy vehicle of the third embodiment

[Explanation of Reference Numerals]

1 toy vehicle

3 front wheel

21 driving link

22 driven link

24 permanent magnet

25 coil

34 rear wheel

[DOCUMENT] ABSTRACT

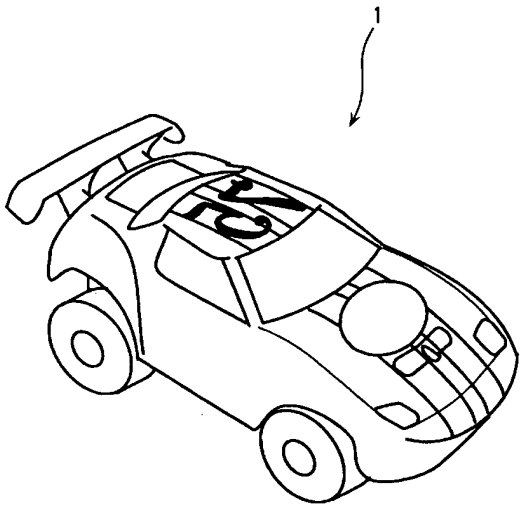
[ABSTRACT]

[OBJECT] To provide a toy vehicle with excellent steering.

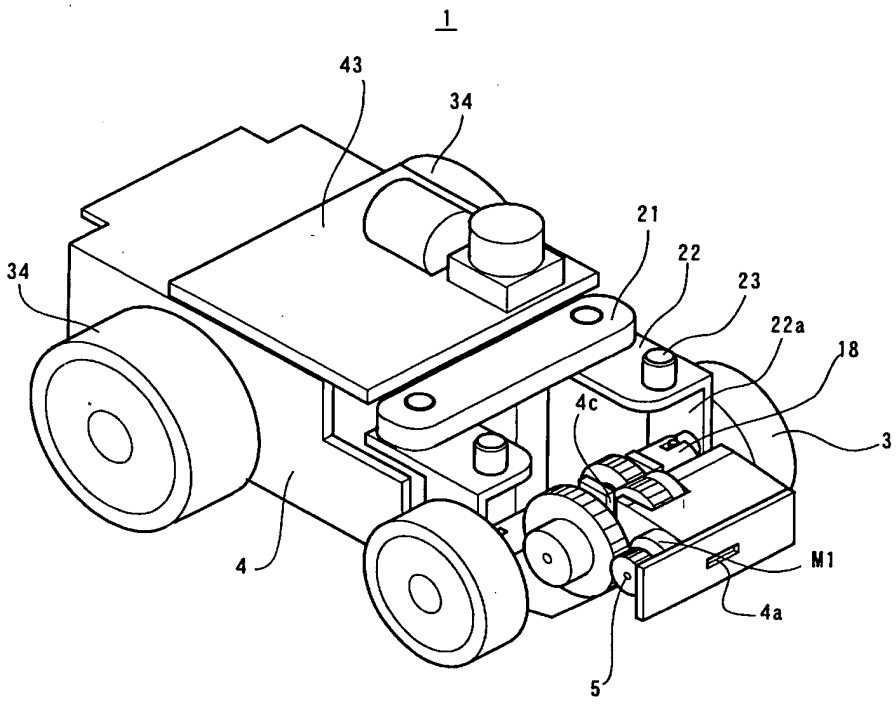
[SOLVING MEANS] A toy vehicle which performs running control and steering control according to a signal from a radio controller, comprising a motor mounted on a front part of a chassis, for driving a front wheel. A position for mounting the motor in this case may be on the front side of a front wheel axle as that of the toy vehicle of a second aspect of the present invention or just behind the front wheel axle.

[SELECTED FIGURE] FIG. 2

[DOCUMENT] DRAWINGS
[FIG. 1]

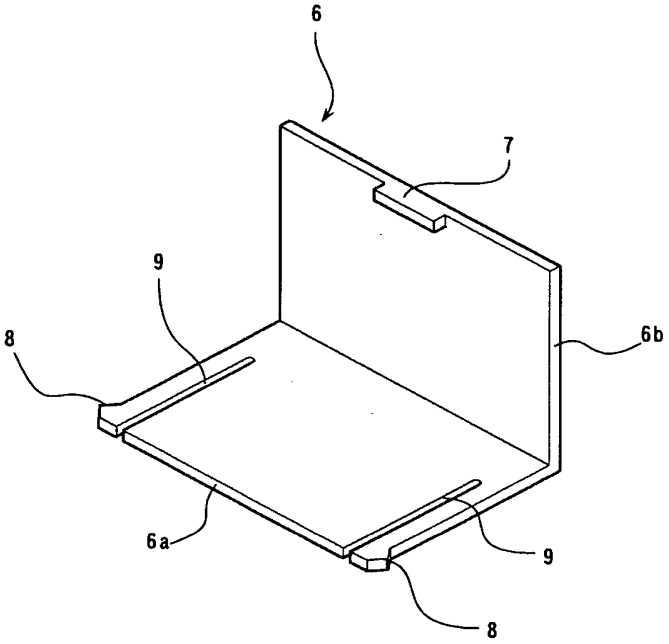


[FIG. 2]



[FIG. 3]

(a)



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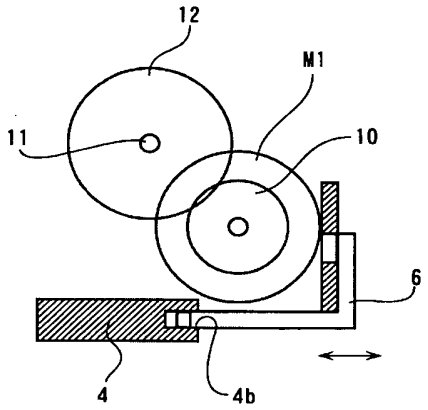
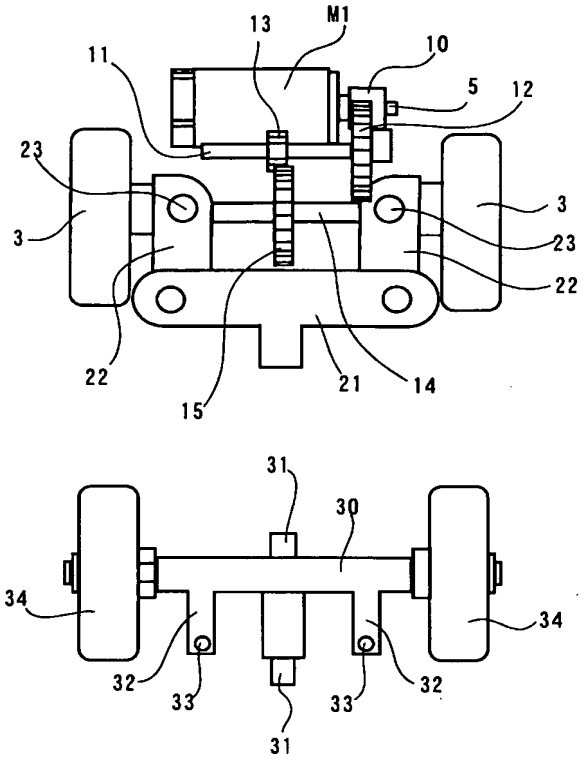
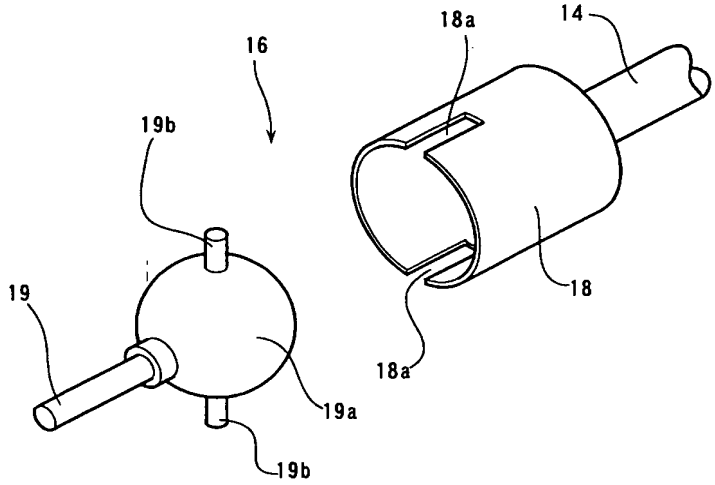


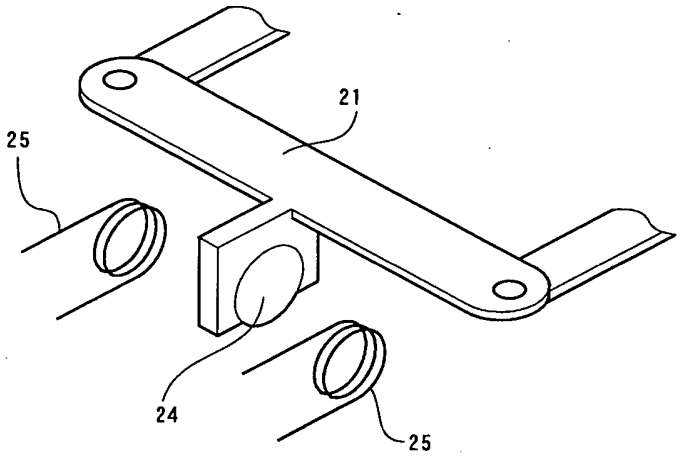
[FIG. 4]


M1
13
10
11
5
12
23
3
3
23
22
22
15
21
14
31
30
34
34
32
33
33
32
31

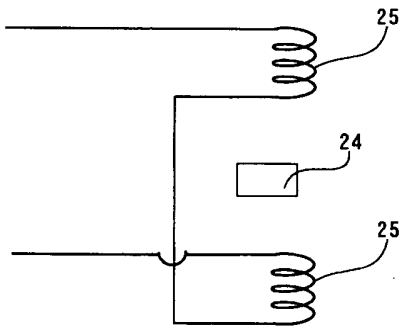
[FIG. 5]


18a
14
16
19b
19
18
18a
19a
19b

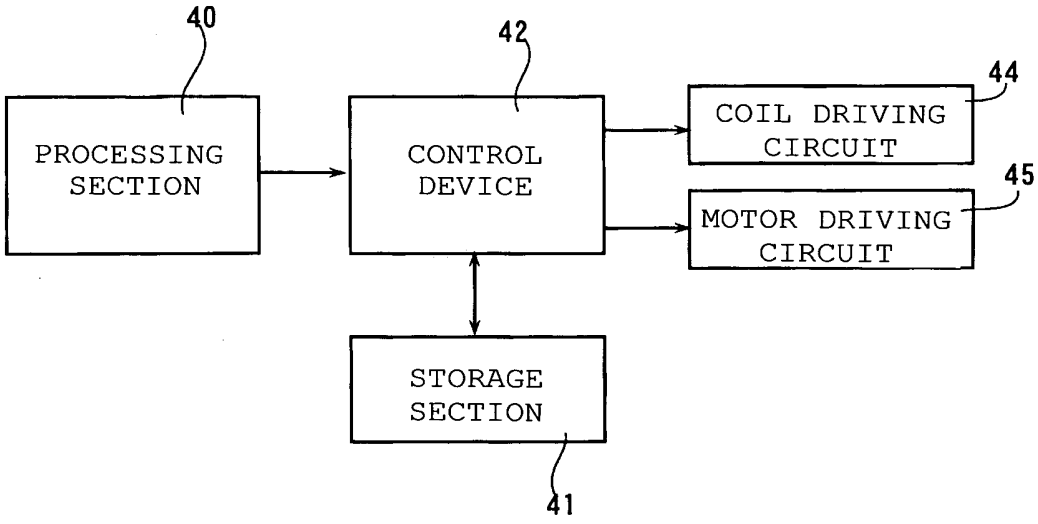
[FIG. 6]



[FIG. 7]



[FIG. 8]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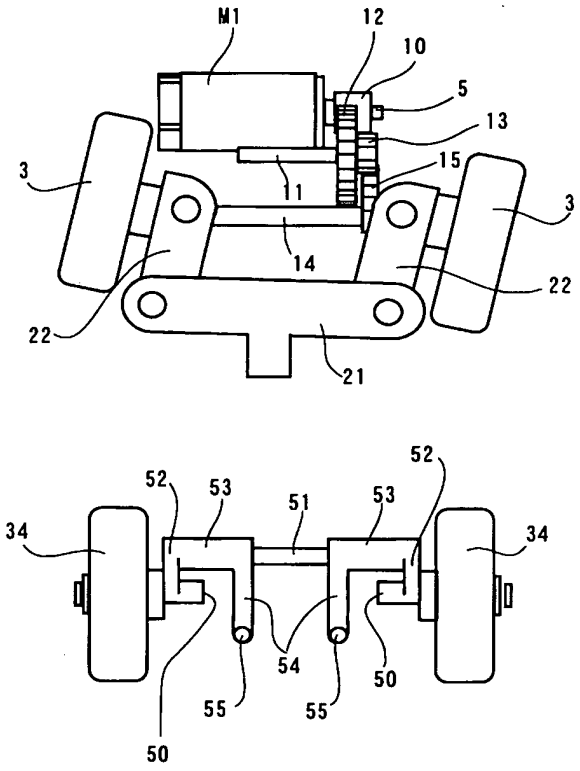
42
44
45
PROCESSING SECTION
CONTROL DEVICE
COIL DRIVING CIRCUIT
MOTOR DRIVING CIRCUIT
STORAGE SECTION
41

[FIG. 9]



[FIG. 10]